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This is an unclassified report of a pilot study, i.e., a study in which insufficient data are available to provide statistically conclusive results. All references to weapons performance have been avoided for security reasons. The following summary statements are, therefore, limited to general evaluations of the capabilities of the networked simulators.

According to the aviator participants, the networking of the simulators proved to be a very valuable training experience which could easily be enhanced by better planning if the equipment were more routinely available. The networked AH-1 and AH-64 simulators allowed an evaluation of the effectiveness of various weapons and tactics used in helicopter air-to-air combat (ATAC). This included the ability to obtain comparative hit and kill ratios for each aircraft as a function of range and weapon. It was also possible to evaluate the additional simulator requirements for helicopter ATAC simulation. The field of view of the visual system was insufficient both horizontally and vertically. In close range engagements, one or

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MULTISIM

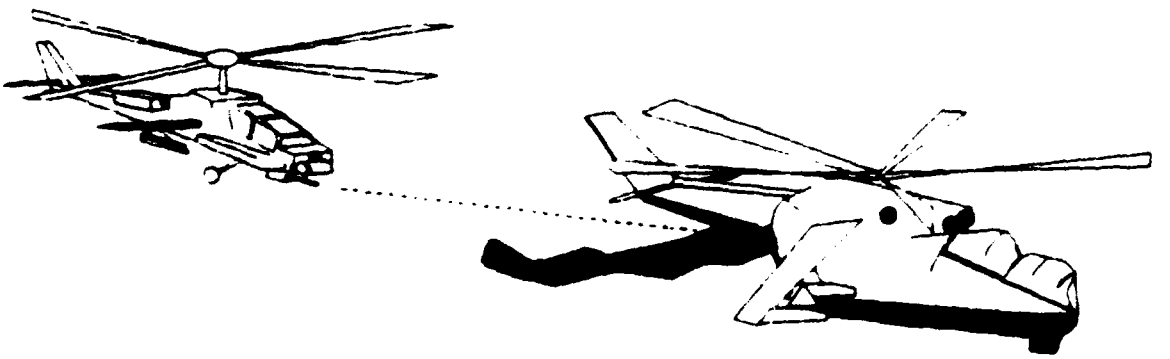
A MINIMUM AIR-TO-AIR COMBAT SIMULATION CAPABILITY

REPORT OF A PILOT STUDY

JAMES W. DEES, PhD

CPT Timothy R. Cornett

December 1988



Directorate of Training and Doctrine
Fort Rucker, Alabama

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MULTISIM

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6 December 1988

EXECUTIVE SUMMARY

This is an unclassified report of a pilot study, i.e., a study in which insufficient data are available to provide statistically conclusive results. All references to weapons performance have been avoided for security reasons. The following summary statements are, therefore, limited to general evaluations of the capabilities of the networked simulators.

According to the aviator participants, the networking of the simulators proved to be a very valuable training experience which could easily be enhanced by better planning if the equipment were more routinely available. The networked AH-1 and AH-64 simulators allowed an evaluation of the effectiveness of various weapons and tactics used in helicopter air-to-air combat (ATAC). This included the ability to obtain comparative hit and kill ratios for each aircraft as a function of range and weapon. It was also possible to evaluate the additional simulator requirements for helicopter ATAC simulation. The field of view of the visual system was insufficient both horizontally and vertically. In close range engagements, one or both simulated aircraft were frequently out of the visual field of the other for extended periods of time. A number of valuable crew comments were provided, as is a list of desired performance measures. The automated weapons scoring capabilities of both simulators were inadequate for testing purposes.

MULTISIM

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1. INTRODUCTION

In August 1988, The Singer Corporation demonstrated a relatively simple networking of the AH-64 Combat Mission Simulator (CMS), AH-1 Flight and Weapons Simulator (FWS), and UH-60 Flight Simulator (FS) at Fort Rucker. At the end of this demonstration, three night shifts were made available for a quick research evaluation of this capability. One AH-64 and one AH-1 crew volunteered to participate in an ATAC pilot study involving their respective aircraft. The sample size of this pilot study is inadequate to draw any conclusions with certainty. However, in this instance, there is so little information on the use of simulators in training helicopter ATAC that even the tentative suggestions of a pilot study are of interest.

2. PROCEDURE

A total of 45 runs was conducted according to the following scenario:

a. Each run began at 1000, 2500 or 4000 meters distance between the two aircraft with both aircraft at an altitude of 50 meters.

b. Each run began with one of three aircraft orientations:

(1) Head-on

(2) AH-64 advantage, i.e., AH-64 behind the AH-1

(3) AH-1 advantage, i.e., AH-1 behind the AH-64

c. The disadvantaged aircraft, if there was one, would either be instructed to run for cover, then turn and fight after reaching cover, or would be instructed to immediately turn and fight.

d. In 30 runs, each crew had its choice of weapons. However, in order to assure a greater amount of data on the rockets, HELLFIRE and TOW weapons, one of these weapons was dictated for use in each of the 15 remaining runs.

e. If the run was not terminated by a kill or crash, it was terminated at the end of three minutes.

3. RESULTS

Only the AH-64 CMS provided suitable data on each firing episode. The AH-1 FWS only provided a summary snapshot for each run. With the exception of these summary data, no AH-1 FWS data were available. Table 1 provides the total number of rounds fired by each AH-64 weapon type as a function of range.

4. CONCLUSIONS

a. The simulation of the gun on the AH-1 included tracers, while the simulation of the gun on the AH-64 did not. According to the gunners, this made the simulated AH-1 gun much more effective.

b. Since neither simulator had an overhead visual system, one crew could fly over the other, then close and kill a blind target. These are artificial conditions. In most actual combat, the existence of surface to air missiles would prohibit ATAC at the altitudes practiced by these crews. Both an overhead visual system and the presence of realistic ground threats are mandatory for the realistic simulation of helicopter ATAC.

c. All four aviator participants stated that the training they received was very valuable. Simply networking two or more attack helicopter simulators together for the purpose of ATAC training will provide a substantial training benefit. However, the following factors should be considered as time and finances permit:

(1) The simulators are already very close to full utilization. In order to provide all of our aviators with adequate networked training on our present simulator fleet, additional simulators would be required.

(2) A wider field of view visual system would be of great benefit in ATAC simulation. An overhead visual scene is particularly important.

(3) A better weapons scoring system is required for most testing. The scoring available on the AH-64 CMS is marginal for test purposes. The scoring system available on the AH-1 FWS is very close to useless. A list of the desired measurements is provided at Appendix B.

(4) The crew in each simulator should be able to talk securely, i.e., without their conversation being overheard by the crew in the other simulator as was the case in this investigation.

(5) Enough simulators should be connected to allow the use of air-to-air tactics, i.e., there should be a wingman.

(6) The aviators in both simulators turned off the motion systems, but expressed a desire to have 'g' seats to provide motion onset cues.

TABLE 1

AH-64
TOTAL ROUNDS FIRED

RANGE 100 M	NUMBER GUN RNDS	PILOT GUN RNDS	COPILOT GUN RNDS	NUMBER ROCKETS	NUMBER HELLFIRE
20 & UP	0	0	0	0	22
19-20	50	0	50	0	0
18-19	0	0	0	0	2
17-18	0	0	0	0	0
16-17	0	0	0	0	0
15-16	10	0	10	0	1
14-15	17	0	17	0	0
13-14	16	0	16	0	1
12-13	5	0	5	0	1
11-12	85	85	0	0	1
10-11	50	0	50	1	0
9-10	32	0	32	2	0
8-9	58	38	20	2	1
7-8	62	15	47	7	0
6-7	115	94	3	18	0
5-6	195	45	150	4	0
4-5	247	214	33	3	0
3-4	284	236	48	28	0
2-3	287	245	42	40	0
1-2	198	147	51	17	0
0-1	207	139	69	9	0
SUM	1918	1247	671	131	29

APPENDIX A

CREW COMMENTS

AH-1 PILOT

1. Crew should be able to talk securely rather than having an open mike where they can be overheard in the other simulator.

2. Pitch and roll constraints should be left out. Mast bumping restriction left in.

3. Should use vectors to assure the opposing aircraft meet each other rather than having an advantaged and disadvantaged aircraft.

4. An overtorque of 120% would crash us. Leave it in the simulator. That's good.

5. The three minute time limit on the run was good, but should fight it out.

6. Concerning cockpit fatigue, you are tired during the graveyard shift, but that is a realistic combat condition.

7. You need a wingman.

8. With a load of 2 TOW, 500 20 mm and 12 rockets plus full fuel, weight and balance were not considered.

9. This exercise on the simulator teaches patience. You must be within range for the 20 mm to be effective.

10. The limited field of view behind, below, and above was a real handicap, but the training was great.

AH-1 COPILOT GUNNER

1. It was a good learning experience.

2. The experience level between the AH-64 and AH-1 crews was very different.

3. A crash in the cobra occurs with a high angle of bank. A 'g' load criterion should be used instead.

4. You need a top canopy to be able to follow in steep banking maneuvers.

5. Simulators don't show the incoming rounds. They should.

6. Tracers are needed on both aircraft simulators. They helped on the AH-1 FWS.

AH-64 PILOT

1. The scenarios used in the study would be a good introduction to acquisition and recognition training.

2. This is basic air-to-air training.

3. You should go into more advanced scenarios with terrain, mission, and orders, and see what the trainees do.

4. To be a superb air-to-air trainer, you need better visuals and a 'g' seat. A wider field of view is required. Better detail would help, but is not critical.

5. How do you deploy to acquire, i.e., do you conceal yourself and go into an overwatch? This should be investigated.

6. A better data recording capability is needed.

7. You need dedicated crews. The tactical expertise was poor in this study.

8. You need isolated communications within crews.

AH-64 COPILOT GUNNER

1. Test results are not valid because of crew inexperience in the first part of the test. Late Friday night, the data was fairly good.

2. No planned setup and ability evaluation.

3. For valid data, 4000 meters should have been first, then moved in closer. The three minute scenarios were good.

5. Communications within the crew must be isolated.

APPENDIX B

SUGGESTED MEASURES IN ADDITION TO

THOSE AVAILABLE NOW ON THE AH-64 CMS

1. Time to first hit by each aircraft

2. Time to kill by each aircraft

3. If there is an advantaged aircraft, the number of times the advantaged aircraft is killed before his adversary is killed

4. Number and type of ordnance expended by each adversary at the time of each of the above criteria

5. Type of ordnance which resulted in each hit

6. Type of ordnance which resulted in each kill

7. Altitude difference between firing and target aircraft at time of hit or miss by missile, rocket, or gun burst (Firing aircraft higher will be positive.)

8. Slant range between firing and target aircraft at time of hit or miss by missile, rocket, or gun burst

9. Difference between angular velocity of target aircraft and munition at time of hit or miss (Gun fire will be considered in bursts. Greater target velocity will be positive.)

10. Difference between the angular acceleration of target aircraft and munition at time of hit or miss (Gun fire will be considered in bursts. Greater target acceleration will be positive.)